Redesign and Prototype for the Interface of a Volumetric Infusion Pump Following the Usability Engineering Lifecycle

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INTRODUCTION

In high-risk industries such as aviation and nuclear power plants have reduced errors by applying human factors engineering – a discipline that designs software, devices, systems, and policies to increase worker efficiency and decrease rates of error. Healthcare has been slow in using human factors principles to reduce medical device errors. The CDRH recognizes that a lack of attention to human factors during product development may lead to errors that have the potential for patient injury or even death.[1] In 2000, the Manufacturer and User Facility Device Experience (MAUDE)MAUDE received 227 reports involving volumetric infusion pump device errors. Eleven of the errors were attributed to user error.[2]

Improvement in interface design requires employing human factors principles from usability engineering. By using human factors techniques, product developers can better understand the cognitive, perceptual, motor capabilities and constraints of the user. They also can understand the user tasks and the constraints of the hardware and software that they are seeking to improve.[3]

The objective of this project was to redesign and prototype an interface for a volumetric infusion pump based on human factors engineering principles.

METHODS

The single channel Gemini volumetric infusion pump was chosen for redesign and prototyping because it is a commonly used infusion device in healthcare. The redesign and prototyping followed the usability engineering life cycle as suggested by Mayhew.[3]

RESULTS

User analysis identified that users ranged from frequently using highly skilled healthcare professionals to infrequent non-professionals delivering care in the home. Usability goals were set that supported the performance of the end user. Identification of platform constraints identified limitations such as display size, colors, and input devices. The conceptual model was based on patient safety. Safety was determined to take precedence over ease of use or speed of data input. The design followed a Top to Bottom and Left to Right Conceptual Model that is consistent with American users. In the user analysis, two user populations working in a tertiary care hospital were tested. The task required them to enter a rate and volume to be infused. Both groups made an error in entering the volume. They entered the rate in the volume to infuse line although the pump instruction clearly called for the volume to be entered in first. The users recognized the error and corrected it before proceeding to the next step. User testing of the prototype led to improvement in the interface such as improved feedback to the user.

CONCLUSIONS

This present study used human factors engineering principles selected from the usability-engineering life cycle to redesign and prototype a volumetric infusion pump interface. The mock-up was tested with a limited number of users. Findings from the field test were used to improve feedback to the user and a more logical task flow.

REFERENCES

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